

## ASSEMBLY

### BACKGROUND OF THE INVENTION

- [1] The present invention relates to assemblies and in particular door panel assemblies of land vehicles such as cars (automobiles).
- [2] Known cars include doors having windows. It is possible to lower and raise a window glass in order to open and close the window. The vertical position of the window glass is controlled by a window regulator, parts of which are generally secured to a lower edge of the window glass.
- [3] Several different forms of window regulator are known. The window glass and the window regulator are positioned in a cavity within the door and are attached to one side (the 'wet' side) of a door panel. The window regulator is driven by components within a window regulator housing mounted on the wet side of the door panel.
- [4] A drive mechanism is attached to the other side (the 'dry' side) of the panel opposite to, and in driving co-operation with components of the window regulator housing. The drive mechanism can comprise a manual arrangement or a powered motor arrangement.
- [5] A problem with known door panel assemblies is to ensure alignment of the window regulator housing with the drive mechanism.

### SUMMARY OF THE INVENTION

- [6] An object of the present invention is to provide an improved form of aligning a first, second and third component of an assembly. The invention is particularly applicable to aligning a window regulator housing (a second component) with a drive mechanism (a third component) when these two components are formed as an assembly with a door panel (a first component). It should be noted that the invention is however applicable to other assemblies where alignment of components is required.
- [7] A further object of the present invention is to provide an improved method of assembling a first, second and third component. A further object of the present

invention is to provide an improved form of partially disassembling a first, second and third component of an assembly.

- [8] Thus according to the present invention there is provided an assembly including a first, second and third component having respective first, second and third holes, the assembly further including a locating means assembled into the first, second and third holes, the locating means having at least a small diameter cylindrical portion which is concentric relative to a large diameter cylindrical portion to provide a shoulder, the locating means further including a fixing portion proximate the small diameter portion for securing the second component relative to the assembly and a fixing portion proximate the large diameter portion for securing the third component relative to the assembly, in which the small diameter cylindrical portion is located in the second hole in order to align the locating means relative to the second component, and a large diameter portion is located in the third hole in order to align the locating means relative to the third component, thereby aligning the second component relative to the third component, in which the first component is situated between the second and third component and also between the shoulder and the second component.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

- [9] The invention will now be described, by way of example only, with reference to the accompanying drawing in which:-
- [10] Figure 1 is a schematic view of an assembly according to the present invention;
- [11] Figure 2 shows the locating means of figure 1, and
- [12] Figures 3 and 3A show an alternative form of assembly according to the present invention.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

- [13] With reference to Figures 1 and 2 there is shown a door panel assembly 10 including a window regulator housing 12 (a second component), a door panel 14 (a first component) and a drive mechanism in the form of a window regulator motor 16 (a third component). In further embodiments the drive mechanism could be in the form of a manual window winder.
- [14] Door panel 14 can be in the form of a door inner skin i.e. a pressed component having various holes and attachment features for components such as door hinges, door latch, audio speaker, window regulator motors etc. Alternatively door panel 14 can be in the form of a door module panel i.e. a panel onto which is pre mounted various components such as a window regulator motor, an audio speaker, a door latch etc, with this pre assembled door module being mounted in a relatively large aperture of a door inner skin.
- [15] Window regulator housing 12 might typically contain a drum around which has been wound a cable, rotation of the drum causing movement of the cable and hence raising and lowering of the window glass via separate components of the window regulator. Note that the present invention is not restricted to window regulators containing drums with cables.
- [16] In particular it should be noted that the arrangement shown in Figure 1 enables power generated by the window regulator motor 16 to be transferred across the door panel to the window regulator to enable raising and lowering of the window. Window regulator motor 16 includes a through hole 16A and door panel 14 includes a through hole 14A.
- [17] Window regulator housing 12 includes a blind hole 12A having a parallel sided portion 18 and a tapered portion 20. The large diameter end of the tapered portion 20 is smaller in diameter than the diameter of the parallel sided portion 18 thus providing a shoulder 22 in hole 12A. In further embodiments Blind hole 12A could include a parallel sided portion in place of tapered portion 20, preferably being of smaller diameter than portion 18.

- [18] The assembly also includes a locating means 24 having a large diameter portion D and small diameter portion d which are concentric relative to each other. A shoulder 26 is provided between the large and small diameter portions. At the end of the small diameter portion remote from shoulder 26 is a tapered threaded portion 28. At the end of the large diameter portion is a paralleled sided threaded portion 30 onto which can be screwed nut 32. At the end of the threaded portion 30 remote from shoulder 26 is a slot 31.
- [19] It should be noted that the large and small diameter portions are designed to be concentric relative to each other. However, manufacturing techniques result in slight eccentricities of the large diameter portion relative to the small diameter portion. However, the design of the large and small diameter portions means that manufacturing techniques, such as turning allow the eccentricities of the large and small diameter portions be minimised. Note that manufacture of the locating means is not limited to making this component as a turned component.
- [20] The assembly 10 can be assembled in two distinct manners. Firstly, the window regulator housing 12 can be aligned relative to the door panel and the locating means 24 (absent the nut 32) can be inserted through hole 14A and into hole 12A. The locating means 24 can then be rotated by means of a screwdriver engaging slot 31 such that the tapered threaded portion 28 engages with the tapered portion 20 of hole 12A. In this case the tapered portion 20 is initially plain sided i.e. it does not include threads and as the locating means is screwed into the hole 12A the tapered threaded portion 28 self taps a thread into the material of window regulator housing 12. In particular the material of window regulator housing 12 can be a plastics material. Such an arrangement provides for a subassembly comprising the locating means 24 which secures the door panel 14 to the window regulator housing 12.
- [21] It should be noted that the length L of the small diameter portion can be slightly less than or slightly greater than the height H of the parallel sided portion 18 plus the thickness T of the door panel 14. The former case provides for a sub assembly in which the door panel 14 is clamped to the window regulator housing 12 and the latter

case provides for an arrangement whereby the shoulder 26 abuts shoulder 22 and the door panel 14 is not clamped relative to the window regulator housing 12. The window regulator motor can then be assembled onto the large diameter portion and the nut 16 can be threaded onto the threaded portion 30 and tightened to provide the complete assembly.

[22] The second way of assembling the components is to be pre assemble the nut 32 onto the locating means 24, align the window regulator housing 12, door panel 14 and window regulator motor 16, and to sequentially insert the locating means 24 through the holes 16A, 14A and 12A and tighten via slot 32 to secure the assembly in one operation. Using the latter method is particularly useful when initially assembling the assembly.

[23] The former method is particularly useful when the window regulator motor 16 requires removal or replacement whereupon the nut 32 can be removed and the window regulator motor 16 also removed and a replacement window regulator motor can then be assembled without having to move the locating means from holes 14A and 12A. Thus it is not required to disturb the connection between the door panel 14 and the window regulator housing 12.

[24] In particular it should be note from Figure 1 that the small diameter portion d is a relatively snug fit within parallel sided portion 18 and also that the large diameter portion D is a relatively snug fit within hole 16A. Thus by controlling the dimensions and manufacturing tolerances on the large and small diameter portions and also on the holes 16A and parallel sided portion 18 it is possible to align the window regulator housing 12 with the window regulator motor 16 relatively accurately. In particular it is often necessary to align these two components relative to each other more accurately than they are aligned relative to the door panel 14, and it will be noted from figure 1 that hole 14A is of significantly larger diameter than hole 12A. Thus under certain installations the dimensional accuracy of hole 14A can be relaxed thereby providing a cheaper assembly.

- [25] The assembly of the window regulator motor, door panel and window regulator housing as described above includes a single locating means 24. However, preferably a plurality of locating means 24 can be assembled into appropriate holes to provide the assembly. Preferably two or three locating means 24 are used. Where a plurality of locating means are used at spaced part locations, then these locating means ensure that the first, second and third components cannot move relative to each other.
- [26] However, it should be noted that where only a single locating means 24 is used then further devices such as tabs, pips, recesses, pins etc can be used to ensure the first, second and third components are fixed relative to each other, in particular to ensure that none of the first, second or third components can be rotated about the axis of the fixing means 24.
- [27] Whilst the locating means 24 has been provided with a drive formation in the form of a slot 31, alternatively drive formations such as hexagonal recesses, hexagonal projections, Torx formations or other suitable drive formations can be provided.
- [28] With reference to Figures 3A and 3B there is shown an alternative form of assembly according to the present invention in which the tapered threaded portion 28 of Figure 2 has been replaced with a rivet 128 which is integral with the locating means 124. Figure 3A shows the rivet having just been inserted through door panel 14 and window regulator housing 12, and Figure 3B shows the rivet having been peened over such that door panel 14, window regulator motor 16 and locating means 124 are retained as a sub assembly.
- [29] Furthermore it is possible to seal the assembly e.g. by providing a seal between the window regulator housing 12 and the door panel 14 or alternatively by providing a seal between the window regulator motor 16 and the door panel 14.
- [30] In further embodiments it is also possible to provide spring washers or other pre-load devices, in particular between the nut 32 and the window regulator motor 16.
- [31] Whilst it is possible to provide an assembly according to the present invention comprising components other than door panels, window regulator mechanisms and

window regulator motors, the invention is particularly applicable to the automotive industry and in particular the first component can be a body pressing panel or other sheet metal component of a car.

- [32] The foregoing description is only exemplary of the principles of the invention. Many modifications and variations of the present invention are possible in light of the above teachings. The preferred embodiments of this invention have been disclosed, however, so that one of ordinary skill in the art would recognize that certain modifications would come within the scope of this invention. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specially described. For that reason the following claims should be studied to determine the true scope and content of this invention.